PINNIPED MONITORING HANDBOOK

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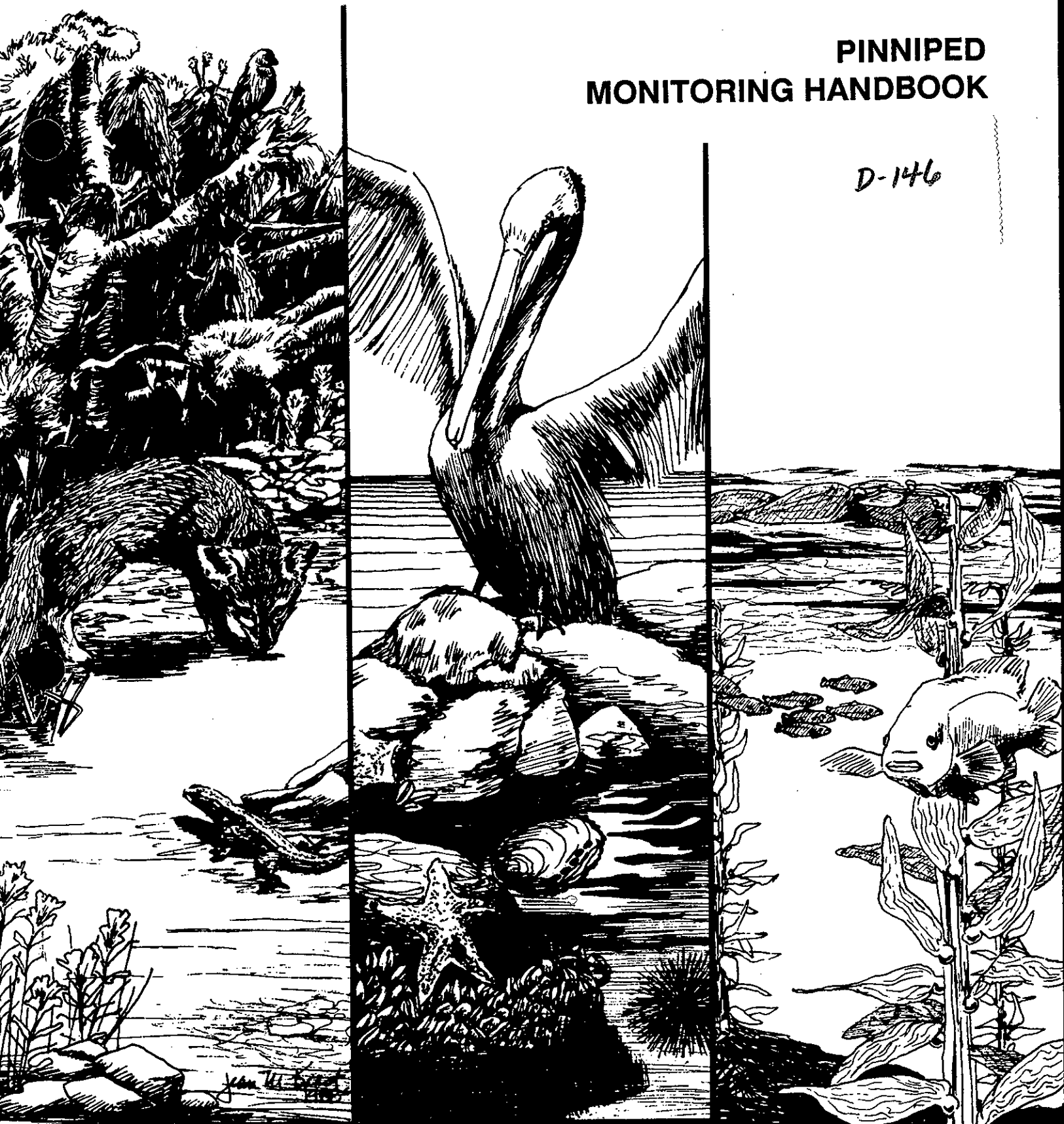

Channel Islands National Park

National Park Service
U.S. Department of the Interior

PINNIPED
MONITORING HANDBOOK

CHANNEL ISLANDS NATIONAL PARK
CALIFORNIA

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INTRODUCTION

This handbook documents what is currently considered to be the best combination of techniques to monitor populations of pinnipeds (seals and sea lions) within Channel Islands National Park and National Marine Sanctuary.

The California Channel Islands and surrounding waters support a larger and more varied population of seals and sea lions than any other area in the world that is immediately accessible from major centers of human population. These marine mammals represent a major scientific resource and a significant recreational attraction. Species belonging to six genera of pinnipeds of two different families occur on these islands. Breeding here are the California sea lion (*Zalophus californianus*), the northern fur seal (*Callorhinus ursinus*), the harbor seal (*Phoca vitulina*), and the northern elephant seal (*Mirounga angustirostris*). The Guadalupe fur seal (*Arctocephalus townwsendi*), and the northern or Steller sea lion (*Eumetopias jubatus*) are known to use these islands as hauling sites but do not breed here.

Pinnipeds are systematically monitored to document long term changes in the distribution and abundance of each species. These changes may be caused by changes in food supply, disease, disturbance to hauling sites by recreational users, entanglement of seals in fishing gear, or changes in hauling habitat due to weathering processes. In addition, oil pollution, pesticides, and heavy metals contamination are known to adversely affect pinnipeds. Ideally, it will be possible to correlate changes in distribution and abundance of pinnipeds with one of the factors mentioned above. However, this is only possible if the amount of natural variability in the system is known following several years of census.

Management responsibility for pinnipeds within the Channel Islands is shared by several federal agencies: the National Marine Fisheries Service, the National Marine Sanctuary Program (both in the Department of Commerce), and the National Park Service (Department of Interior). The individual responsibilities of each agency are specified in the Marine Mammal Protection Act of 1972 (MMPA); the Magnusen Fisheries Conservation Management Act of 1978; Public Law 96-199 (the law that established Channel Islands National Park); and the Marine Protection, Research, and Sanctuaries Act of 1972. In addition, the State of California is concerned about the management of pinnipeds in California and may request management authority, as described in recent amendments to the MMPA. Pinniped management is complex and requires sound management of pinniped prey species; regulation of access to areas critical to feeding, breeding, and hauling; monitoring of marine mammal/fishery interactions; and coordination with agencies responsible for mineral development.

MONITORING DESIGN CONSIDERATIONS

While six species of pinnipeds haul out on park beaches and use park waters, only the four most abundant (California sea lion, northern elephant seal, harbor seal, and northern fur seal) were selected for detailed long-term monitoring. The other two species (northern or Steller sea lion and Guadalupe fur seal) occur so infrequently that it is not feasible to routinely monitor their population dynamics. However, areas historically used by these species will be surveyed and their presence recorded.

All beaches on the five park islands have been selected for monitoring through ground and/or aerial census techniques. However, application of the techniques vary for each species and for certain rookery areas because of characteristics of the species monitored (such as sensitivity to disturbance and timing of pupping) and species distribution.

Two basic types of indexes are used to monitor changes in populations of wildlife. They are:

- indexes that track the size of the population
- indexes that track the "condition" of an average individual in the population (Hanks 1981).

Population indexes characterize changes in population size independent of environmental or habitat conditions. Population indexes that are commonly used in pinniped management include counts of pups, counts of hauled animals, and mark/recapture estimates of an entire population (Eberhardt 1978). Condition indexes track how the average condition of an animal in a population changes over time. Therefore, these indexes may change when the population level is constant, but habitat conditions vary. Commonly used condition indexes in pinniped management include the average age of sexual maturity, the average

age of the population, length to girth ratios, rates of agonistic encounters, food habits, and time spent feeding. Other condition indexes are described in Eberhardt and Siniff (1977).

Prudent management of wildlife resources requires that both types of indexes are used (DeMaster 1984). When these indexes are used in combination, it is possible to discriminate between a population that is declining because of a reduction in habitat quality versus a reduction caused by high levels of incidental take. It is also possible to predict whether a population is likely to decline, increase, or remain constant. Without this dual-index approach, it is neither possible to determine causes of changes observed in population levels, nor to tailor prudent management responses.

This handbook only describes techniques used to monitor changes in population size (population indexes) because this is the level of long-term monitoring likely to continue under present funding. A sound resource management program should include the monitoring techniques described in this handbook, as well as research designed to monitor the condition of animals in the population. Funds to initiate monitoring of pinniped condition will be requested in cooperation with National Marine Fisheries Service and California Fish and Game.

MONITORING PROTOCOL

SAMPLING METHODS

Three techniques are currently used to index the population levels of pinnipeds in the southern California Bight:

- ground counts at rookeries
- aerial counts where counts of animals are made from 35-mm transparencies (photographs taken at oblique angle)
- aerial counts where counts of animals are made from 5-inch transparencies (photographs are taken at a vertical angle)

A comparison of these techniques is provided in Table 1.

1. Ground Counts

Ground counts are generally considered to be the most accurate technique for counting pups in large rookeries in southern California. Other techniques usually underestimate the number of pups present. Ground counts also provide an opportunity to collect information on condition indexes, such as food habits, tag resights, and weight at weaning. If the rookery is easily accessible, ground counts are usually the least expensive of the three techniques. The major disadvantage of ground counts is the amount of disturbance which can, if frequent enough, lead to changes in the distribution of animals. Therefore, counts must be made with minimal disturbance. Ground counts are used to census pup production in California sea lion, northern elephant seal, and northern fur seal breeding colonies. Counts are made after all pups have been born and when most pups are congregated into large groups. Counts are made before pups begin to swim. It is also desirable to schedule counts after most breeding activity has been completed, because most of the breeding females and males have returned to the sea to feed.

2. Aerial Counts (35-mm Format Photographs)

Aerial counts from 35-mm transparencies (oblique photographs) are ideal for monitoring the distribution of rookeries and hauling sites. This technique is used to enumerate pinnipeds when they are relatively dispersed or to obtain a qualitative description of the distribution of rookeries. For example, this procedure is effectively used to census sea lions outside of the breeding rookeries and harbor seals throughout the Channel Islands. Coverage is relatively inexpensive and photographs for an entire census can be contracted for about $3000.

Surveys are made while flying at altitudes of 150-300 m and 50-100 m offshore. Flights are made in twin engine, high-wing aircraft. Hauling sites are photographed with a high quality 35-mm camera with a 200-mm and a 43 to 80-mm zoom lens, and a motor drive. High speed film (200 to 400 ASA) is used. The survey team consists of a pilot, observer/photographer, and an assistant who serves as an observer and data recorder. Pinniped hauling areas are recorded on standard maps for each island. Voice recordings of the flights are made using a portable cassette recorder. Use of experienced observers is critical to obtain precise estimates with this technique. Inexperienced observers should initially be used as recorders only.

Counts of pinnipeds are obtained by projecting processed slides on a large viewing screen or by viewing under a microscope. The total numbers of pinnipeds and pups present are scored for each area.

One major advantage of this technique is that all five islands can be photographed in about four hours, reducing the probability of double counting animals on consecutive days. However, a number of problems should be recognized. One, it is very difficult to enumerate pups from photographs because pups can easily blend in with the background and are often confused with yearlings or two-year old animals. Pups will generally be missed, unless light conditions are ideal and animals are dry. Secondly, animals in dense concentrations are also very difficult to accurately enumerate. Finally, if a hauling site is disturbed just before the overflight, animals will not be available to photograph. Therefore, flights must be timed when vessel traffic and human use of beaches are at a minimum. In addition, peak hauling times of many species will vary by time of day and season, and this must be considered when planning surveys. For these reasons, it is often advisable to replicate aerial surveys to get more precise estimates.

Actual counts of animals from the air (rather than photographing the area and then counting from transparencies) are made when only a few animals are

Table 1. Summary of Pinniped Census Techniques and Their Requirements.

TECHNIQUES	REQUIREMENTS/EQUIPMENT	COMMENTS
Ground Counts	Minimum 2 people	Disturbance can be problem
	Clicker counters	Information on tags, ages, food habits
	Binoculars	Least biased
	Spotting scope	Demands most effort
Aerial Counts (35-mm format photographs)	Beach Travelair, Cessna skymaster, or similar aircraft	Usually underestimates pups
	Altitude: 150-300 m	Good for distribution
	50-100 m offshore	Best done in replicate
	35-mm camera w/motor drive, 200-mm and 43 to 80-mm zoom lens	Permanent record made
	High speed (400 ASA) color film	Fly during peak haulout
	Cassette recorder	
	Dissecting scope or slide projector	
Aerial Counts (5-inch format photographs)	Contract with experienced photogrammetric firm necessary unless access to camera is possible	$20 per frame plus air time (15 frames for Point Bennett)
	Experienced person to interpret imagery	Interpretation takes about about 40 hr/census
	Altitude: 150-300 m	Best with elephant seals
	Directly over hauled pinnipeds	Permanent record made
	Pre-survey determination of transects	Distribution on beach and length easily determined
		Fly during hauling periods

found on isolated beaches. Clicker counters and voice recordings using a portable cassette are used to count and record these visual aerial counts.

3. Aerial Counts (5-inch Format Photographs)

Aerial counts are made from photographs taken with vertically mounted, high resolution military reconnaissance cameras. The photographs are taken from an aircraft flying at altitudes between 180 and 250 m above the rookeries. At these low altitudes, it is essential that the photographs are taken with cameras that have a forward image compensation system. By eliminating the image smear that is caused by the forward movement of the aircraft while the shutter is open, photographs of exceptionally high resolution can be taken. The advantage of this technique are: the photographs represent a permanent record of the distribution and numbers of animals present; the size and spatial relationships of the animals present can be determined from the photographs; there is no disturbance to the rookery associated with the survey; and a wide range of sites can be surveyed within a few hours and at relatively small expense ($1800 to collect and process vertical photographs for all northern elephant seal rookeries within Channel Islands National Park). Problems with this technique include the high cost of the photographic and image interpretation equipment and the amount of time required to make accurate counts from the images. A complete count of northern elephant seal pup production at San Miguel Island from aerial photographs takes about 30 hours to complete.

Photographic missions should be scheduled for midday. Census flights should be made on relatively cool days, preferably with a high overcast. Under these conditions, fewer pups (California sea lions or northern fur seals) will be in crevasses or in tide pools where they are harder to count.

As with aerial surveys involving 35-mm photography, daily and seasonal hauling patterns and effects of disturbance must be taken into account with timing overflights. This technique allows an estimate of animal length to be taken directly from the image and allows for an analysis of spatial distribution, which oblique, 35-mm imagery does not offer. This technique is best suited for monitoring sandy beaches, like Point Bennett, where the contrast between animals and substrate is great.

Schedule and Location of Monitoring

A schedule for monitoring each species is found in Table 2. The table also indicates appropriate techniques and which islands to monitor for selected species.

Current distribution of pinnipeds by beach is summarized in Appendix A. The numbered locations in the appendix refer to a standardized numbering system of island beaches called BLM codes. This numbering system was developed by researchers from the University of California, Santa Cruz as part of their work for the Bureau of Land Management to indicate marine mammal distribution in southern California. Through the use of these consistent location codes, an efficient reporting system can be maintained.

Any changes in distribution or new trends in pup production from the existing distribution of pinnipeds must be monitored. For example, Santa Barbara Island has a small rookery for sea lion and elephant seal pupping. Changes in current distribution of these pupping beaches need to be monitored. Historically, northern sea lions (and possibly California sea lions) pupped at Santa Cruz and Santa Rosa islands. These beaches should be carefully examined during the breeding season for signs of recolonization.

Scheduling of counts must take into account permit requirements. Permits are required prior to aerial and ground surveys under the Marine Mammal Protection Act. Application for permits should be made well in advance from the National Marine Fisheries Service which may take up to 120 days to process and grant the permit.

Recording the Data

All census data are recorded so that it can be easily transcribed on the pinniped census data form (Appendix B). Use of the data entry form will help ensure that data are collected consistently from year to year and will allow the data to be more easily managed.

Any dead or beached cetaceans (whales or dolphins) should be reported to the Southwest Regional Office of the National Marine Fisheries Service.

Table 2. Schedule and Location of Counts for Pinniped Monitoring

DATES	TARGET SPECIES AND AGE	LOCATION - TECHNIQUE
February 14-28	Northern elephant seal (pup production)	SMI - GO, A5 SRI - A3 SCI - A3 ANI - A3 SBI - A5
April 14-28	Harbor seal (pup production)	SMI - A3 SRI - A3 SCI - A3 ANI - A3 SBI - A3
May 1 - 15	California sea lion (premature births)	SMI - GO
May 25 - June 10	Harbor seal SMI - A3 (all hauled animals)	SRI - A3 SCI - A3 ANI - A3 SBI - A3
July 15-30	California sea lion Northern fur seal Guadalupe fur seal Northern sea lion	SMI - GO, A5 SRI - A3 SCI - A3 ANI - A3 SBI - A5

Location

SMI - San Miguel Island
SRI - Santa Rosa Island
SCI - Santa Cruz Island
ANI - Anacapa Island
SBI - Santa Barbara Island

Technique

GO - Ground counts at preselected haulouts
A3 - Aerial Counts, 35-mm format photographs
A5 - Aerial Counts, 5-inch format photographs

Monitoring Techniques by Target Species

California Sea Lions

Premature Births at San Miguel Island

A ground survey of all hauling areas on Point Bennett is made in early May to document the number of premature births. Two to three biologists survey all hauling areas on foot and record the number of premature sea lion pup carcasses. The biologists work independently. Carcasses are marked with red surveyors tape and deposited in groups of 10 to 20 in single locations in each general area to avoid recounting in later surveys in May or to avoid counting as full term neonatal mortalities in late July. The numbers of premature pups counted by each biologist are summed for each general area and later for all of Point Bennett. A thorough survey requires seven to eight hours to complete.

Pup Production

Sea lion hauling and breeding areas in the Point Bennett area are surveyed in late July and early August to document peak pup abundance. Most pups are born by June 20 and the majority of these remain on the rookery through early August. Breeding occurs from about June 20 to July 20. By late July, female abundance declines as an increasing number of parous females lengthen their feeding trips at sea. Following the breeding season, many adult males return to sea. Therefore, all live pups are present on the rookery in late July and many of the lactating females and the males are at sea.

Ground censuses are conducted on sunny days with little or no wind to minimize the effects of disturbance. Censuses are begun late in the morning when most animals have moved from the interior hauling grounds to, or just above, the splash zone. A team of two to four biologists, experienced in censusing pups, walks slowly well above the beach crest to "ease" the adults into the water but yet far enough from the pups so that they neither panic nor move about very much. Subsections are then selected by the team and pups in that subsection are enumerated by each biologist. The counts for each subsection are compared and accepted only if they are within 10 percent of the mean count. If not, counts for the subsection are repeated. Each biologist's counts are summed for the subsections. Pup production is estimated as the average of all of the total counts for the team.

At Castle Rock, a team of two biologists are used to enumerate pups. Adult and sub-adult animals are "eased" into the water. A great deal of care is needed to avoid injury to animals as they are pushed toward the water. Once the adults and sub-adults are cleared, pups are counted as described for Point Bennett. This survey is ideally done between 1000 and 1400 hours and generally takes two hours to complete.

Sea lion pups at Santa Barbara Island are counted by ground surveys conducted in late July as described above for Point Bennett. Ground counts are difficult at Santa Barbara Island and should be conducted carefully to minimize disturbance. A single, experienced observer can move slowly above the rookeries to make counts with a minimum of disturbance. Gulls also disturb the sea lions, so observers must also minimize disturbance to gulls as well.

Aerial surveys using 5-inch format photographs are made in the last two weeks of July at San Miguel and Santa Barbara islands. Flights should be made at mid-day with a relatively low tide. Ideally, photographs will be taken on a cool day with some cloud cover to reduce the number of pups that will seek shady areas or go into the water to escape the heat. Photographs should cover Point Bennett, Castle Rock, Richardson Rock, Judith Rock, and all of Santa Barbara Island.

Hauled Animals Outside Breeding Rookeries

Surveys of hauled sea lions outside of breeding rookeries are conducted by aircraft, and counts are made from 35-mm color photographs. Surveys are flown during selected times (as indicated in schedule in Table 2). Special attention should be given to historically used hauling sites and rookeries. Counts made during the breeding season are used to document changes in the distribution of rookeries. Counts made outside of the breeding season are used to monitor any changes in the distribution of hauling that may be associated with seasonal hauling patterns, vessel traffic, and beach disturbance.

Northern Fur Seals

Northern fur seals occur only at Adams Cove on San Miguel Island and on nearby Castle Rock. Pupping generally begins in late May and is completed by late July. The mean date of birth is June 26. Pup production and mortality can be monitored daily from observation blinds along the bluffs overlooking Adams Cove with binoculars or 15-60x telescopes throughout the breeding season. This is becoming more and more difficult as pups are now distributed all the way to the spit leading to Cormorant Rock. Counts of pups at Castle Rock and Adams Cove are conducted during the California sea lion ground or aerial counts for pups.

Northern Elephant Seals

A ground count of elephant seal pups is made during the last two weeks of February on San Miguel and Santa Barbara islands. Most of the cows have left by this date. At San Miguel Island, pups will be in large concentrations inland of the beach crest, as well as in isolated groups in the arroyos of Adams Cove. In addition, cows and pups will be scattered along the entire south side of San Miguel Island and in Otter Harbor. At Point Bennett, counts are made by two observers. Discrete areas of the beach are marked in the sand, and counts of all elephant seal pups are made within a subsection by both observers. Subsections are about 20 m to 40 m wide and no more than 100 m long. If counts are not within 10 percent of each other, additional counts are made until agreement is reached. The entire point can be counted in about 6 hours by experienced observers. Counts at each beach are tallied separately.

An aerial survey (5-inch format) is made at the same time as the ground count at San Miguel Island. All breeding sites are photographed. Pups, adult females, and adult males are enumerated from the imagery.

At Santa Barbara Island, pups can be counted by ground observers from the cliffs above the rookeries with 7-10x binoculars. This survey takes about 3 hours. Aerial surveys of elephant seal pups are also made. The overhanging cliffs of the north side of the island make vertical photography impractical. In this area the aircraft should be banked so that shallow angle oblique photographs can be collected.

Harbor Seals

For Pacific harbor seals, the entire cohort of pups is never hauled out simultaneously. The period of pupping extends over a two-month period, while the weaning period is less than one month after parturition. Pup production is measured through aerial counts made in mid- to late April. These counts are considered minimum estimates of pup production and are used to establish temporal trends in pup production from island to island.

The proportion of the total population that is hauled out will vary by time of day, area, tides, weather, and season. The most consistent and highest proportion of the total population will haul out in early afternoon during the molt period. Therefore, counts of harbor seals (hauled animals) should be made at mid-day during the molt period of late May to early June. Ideally, a series of two to five daily counts are made in order to estimate the daily variation in hauled animals.

Neither pup counts nor counts of hauled animals provide a good estimate of the total population. However, if counts are made annually at a consistent time of year using the same techniques, the data can be used to monitor changes in distribution and relative abundance of harbor seals.

Harbor seal surveys are made using an oblique aerial survey with 35-mm transparencies as described under aerial counts (35-mm photographs). Total numbers of harbor seals and numbers of pups present are counted from the projected slides.

Guadalupe Fur Seals and Northern Sea Lions

These two species have been seen hauled out only in the Point Bennett area and at Castle Rock on San Miguel Island in recent years (1980 to present). Fewer than three Guadalupe fur seals and six northern sea lions have been counted at any one time since 1981. Although two northern sea lion pups at San Miguel Island (Castle Rock) were reported in 1981, there have been no pups reported for either species since 1982. Castle Rock is difficult to census and only experienced research personnel should survey Castle Rock for either species. To document the presence of adults and pups of both species, check Point Bennett and Castle Rock where they have been previously reported from early June to late July.

DATA MANAGEMENT

Analysis

Total counts of all seals and pups are analyzed in two ways. First, a qualitative comparison of beach use for both pupping and hauling for all six species is made from year to year. Changes in haul out patterns can reflect changes in population levels or changes in the level of disturbance around areas critical to breeding and feeding. A second analysis involves a quantitative comparison of the population index of choice for each species. Counts are presented by year and by island. A regression of log-transformed counts against time can be fitted to a straight line to determine the rate of growth of the population. A significantly positive slope implies the population is increasing. A negative slope implies the population is decreasing. A nonsignificant slope infers that there is no consistent change in population size. Additional information can be gained by looking at the pattern in the residuals or fitting a second degree polynomial to the data set (DeMaster et al. 1982, Boveng et al. 1988).

Reporting

A report generating system has been developed at the Southwest Fisheries Center to facilitate rapid presentation of survey data collected in a specified form based on the pinniped census form (Berkson 1984). The system involves an interactive, user friendly program to manipulate information from specified surveys. The computer prompts the user to specify types of information desired and then requests the user to designate an output format. Plots or tables can be generated for counts by age/sex class, species, island, year, and month. In addition, plots or tables of the percentage of a particular age/sex class of a species relative to the total number of counted animals can be generated.

LITERATURE CITED

Berkson, J. M. 1984. Aerial pinniped survey database and report generating system. SWFC Adm. Report LJ-84-29C, 54pp.

Bonnell, M. L., B. J. LeBoeuf, M. O. Pierson, D. H. Dettman, D. D. Farrens, C. B. Heath, R. F. Gantt, and D. J. Larsen., 1980. Pinnipeds of the Southern California Bight. *In*: Marine mammal and seabird surveys of the Southern California Bight area 1975-1978. Vol. 3 - Investigator's Reports, Part 1. NTIS PB81-248-71. 535pp.

Boveng, P., D. P. DeMaster, and B. S. Stewart. 1988. Dynamic response analysis III. A consistency filter and application to four northern elephant seal colonies. Marine Mammal Science: 210-222.

DeMaster, D. P. 1984. A review of density dependence in marine mammals. *In*: Proceedings from the Symposium of Biological Interactions among Marine Mammals and Commercial Fisheries in the Southeastern Bering Sea. Alaska Sea Grant Report 84-1, 300pp.

DeMaster, D. P., D. J. Miller, D. Goodman, R. Delong, and B. S. Stewart. 1982. Assessment of California sea lion fishery interactions. In: Trans. N. Amer. Wild. Nat. Res. Conf. 47:253-264.

Eberhardt, L. L. 1978. Transect methods for population studies. J. Wildl. Manage. 42(1):1-31.

Eberhardt, L. L., D. B. Siniff. 1977. Population dynamics and marine mammal management policies. J. Fisheries Research Board of Canada. 34:183-190.

Hanks, J. 1981. Characterization of population condition. *In*: Dynamics of large mammal populations (ed. C. W. Fowler and T. D. Smith). John Wiley and Sons. New York. 477pp.

Stewart. B. S. 1981. Aerial survey of harbor seals (*Phoca vitulina richards*) at the California Channel Islands; 27-29 June 1981. HSWRI Tech. Rept. 81-129.

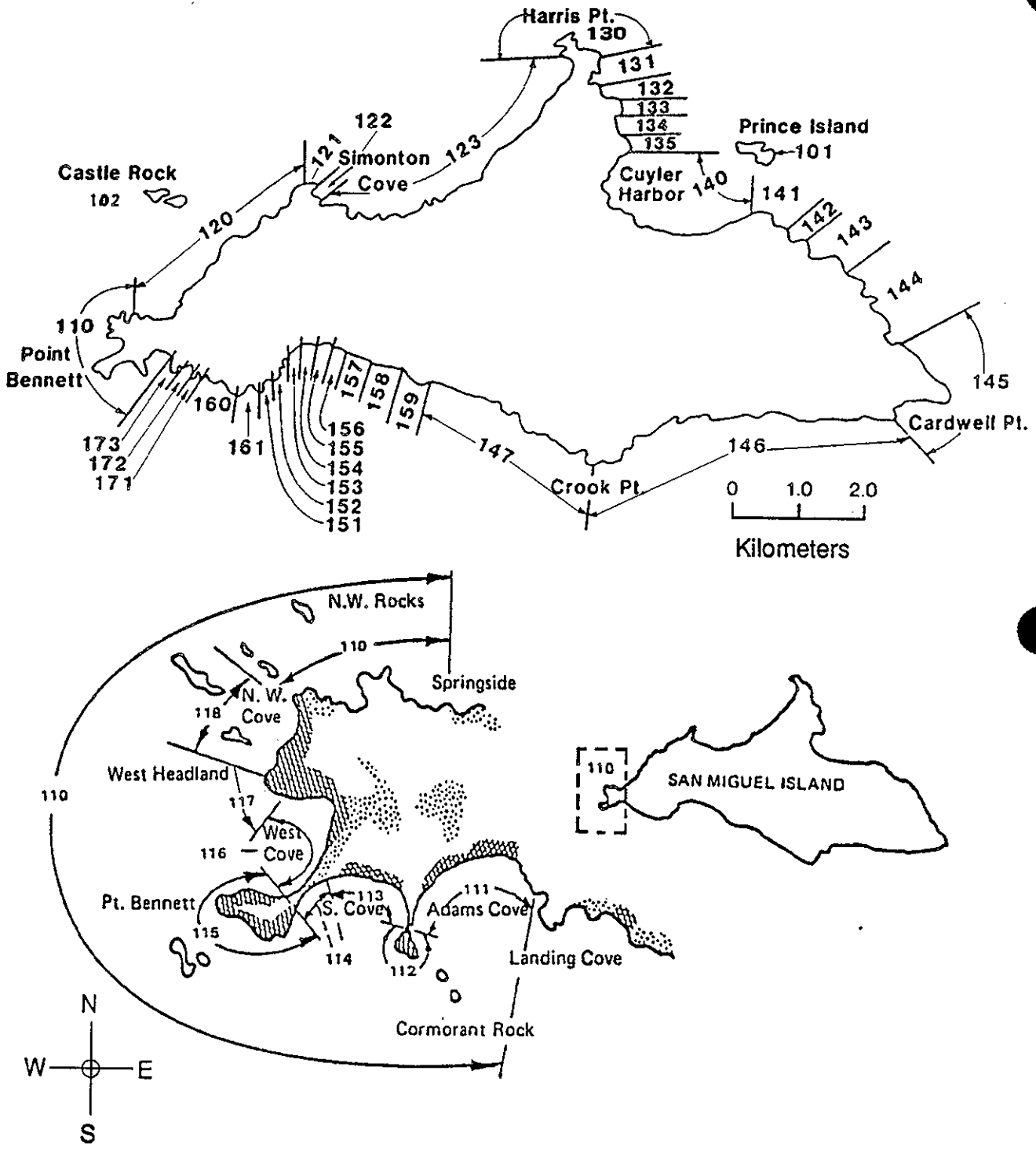
Stewart, B. S. 1982. Studies on the pinnipeds of the Southern California Channel Islands, 1980-1981. HSWRI Tech. Rept. 82-136.

APPENDIX A. Distribution of Pinnipeds and Maps of BLM Location Codes

Table A-1. Distribution of Pinnipeds by Beach. Data are from 1975-1982 (Bonnel et al. 1980 and Stewart 1981, 1982).

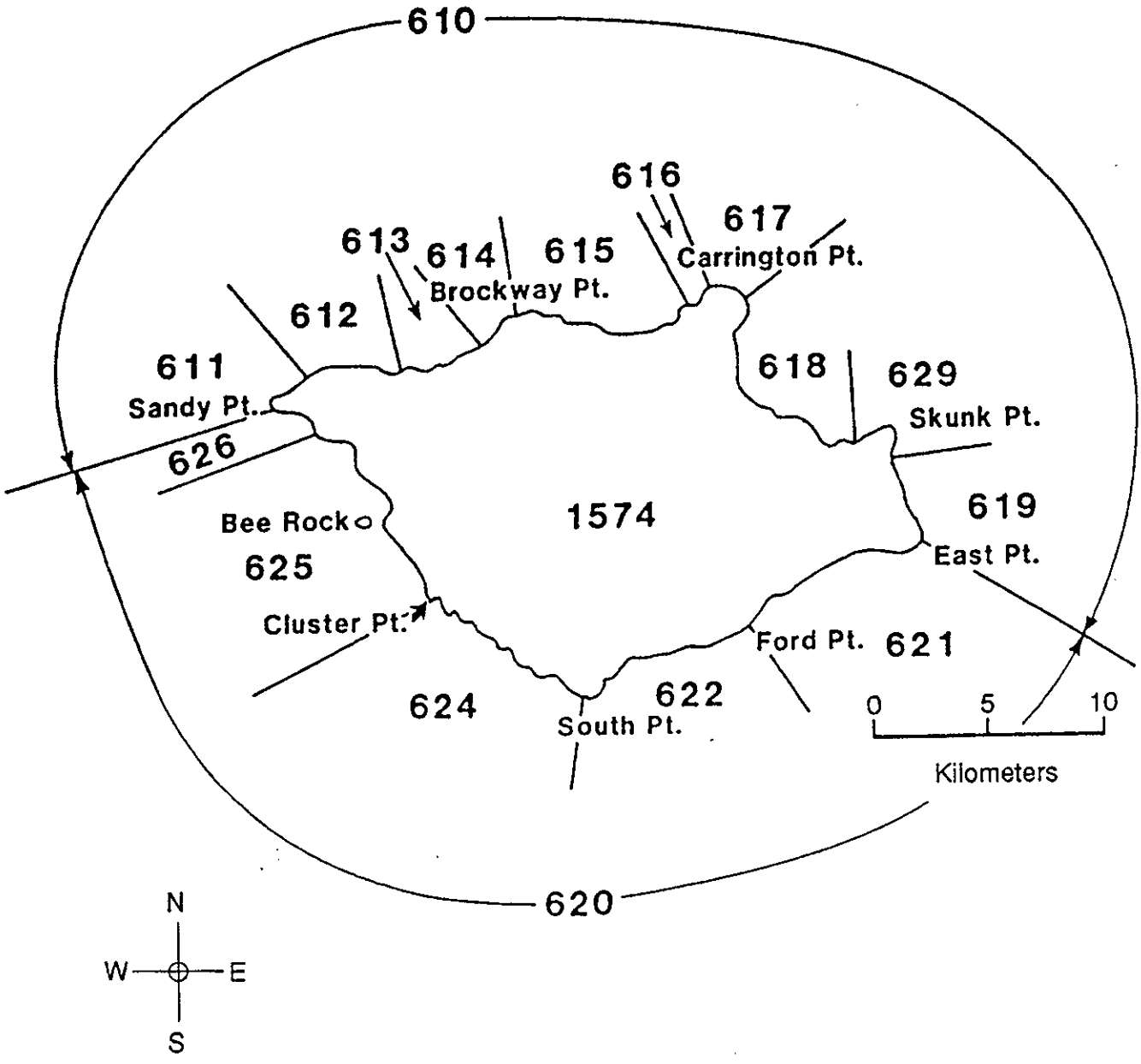
SPECIES	SAN MIGUEL ISLAND	SANTA ROSA ISLAND	SANTA CRUZ ISLAND	ANACAPA ISLAND	SANTA BARBARA ISLAND
Northern fur seal	102* 111*				
Northern elephant seal	110* 119* 120* 146* 147* 151*-159* 161 171 172				302-304 308 310* 311 317 322
California sea lion	102* 103* 110*-119* 120 151-156 161 171* 172	615 621	641 643 645 646 648 649	660 670 680	302* 303* 304-307 308*-312* 313 314 317* 318* 322-324 325*
Harbor seal	121 122* 123 130*-132* 134* 142*-144* 145 146* 147* 157* 159*	611 612*-615* 617*-619* 621* 622 624*-626*	641* 643 645* 647* 649* 651* 653 654* 656* 658*	660* 670* 680	306 316*
Northern sea lion	110 111				
Guadalupe fur seal	110 111				

* indicates pupping occurs on that beach
Numbers refer to BLM location codes in Figures A-1 to A-5.



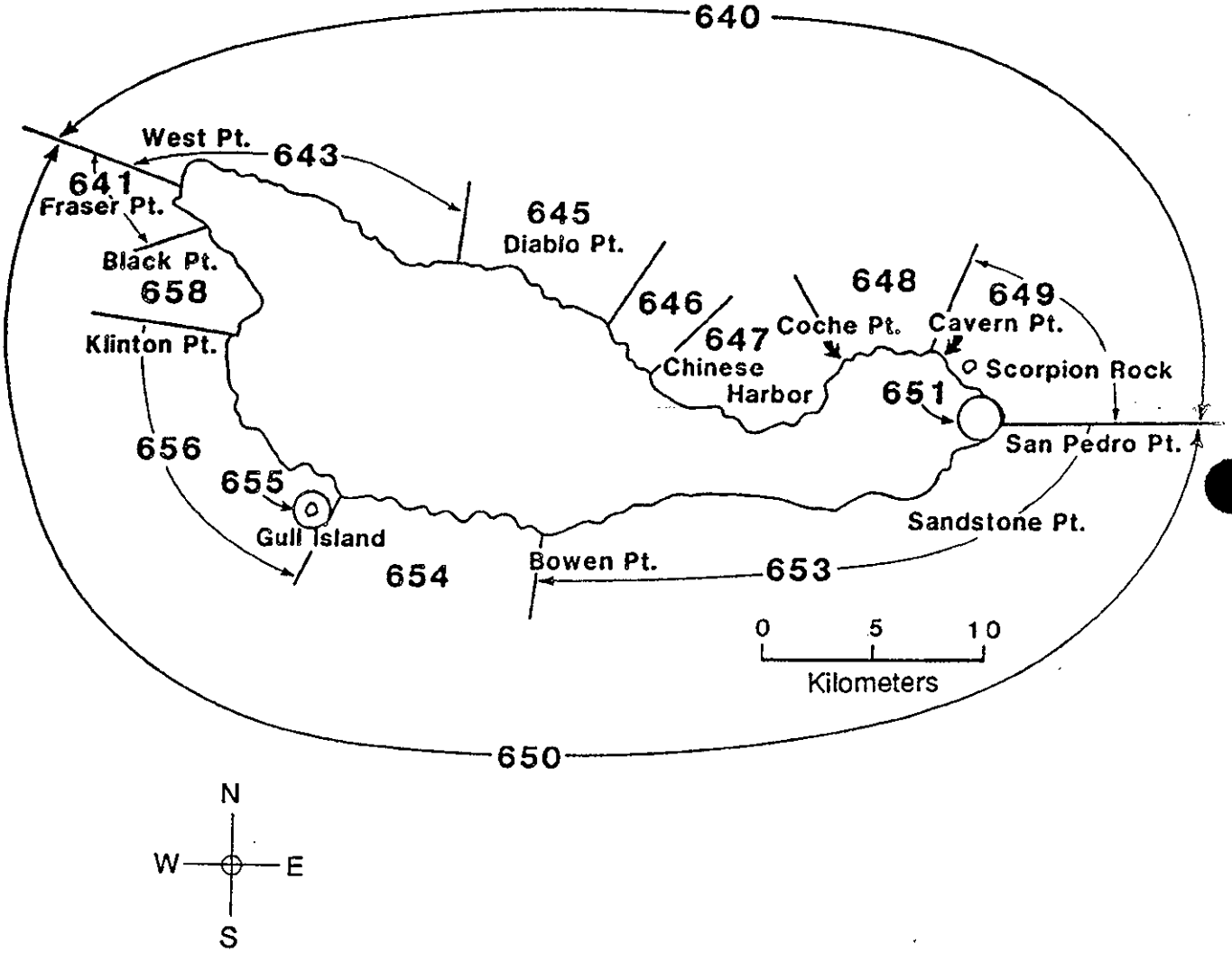
SAN MIGUEL ISLAND

Figure A - 1. Pinniped BLM Location Codes



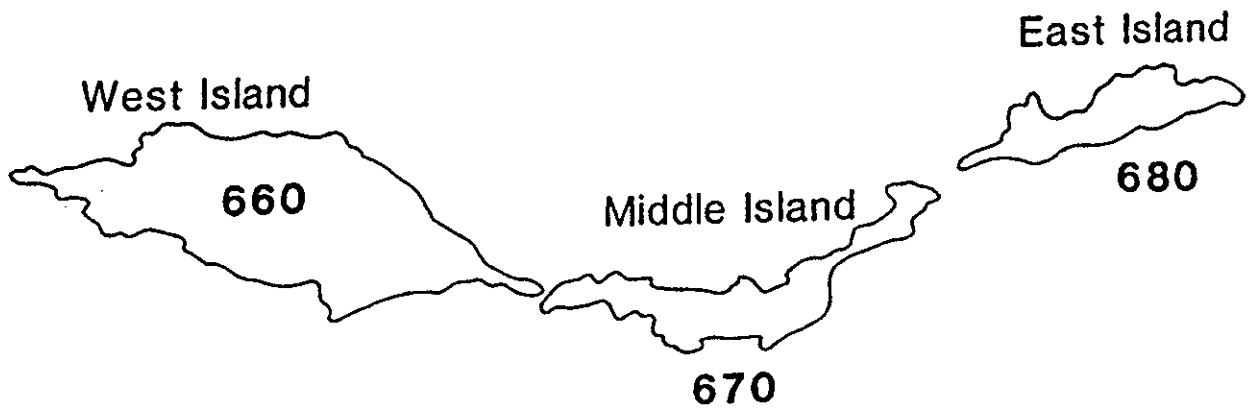
SANTA ROSA ISLAND

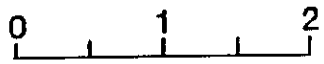
Figure A - 2. Pinniped BLM Location Codes

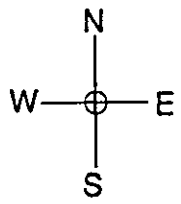


SANTA CRUZ ISLAND

Figure A - 3. Pinniped BLM Location Codes

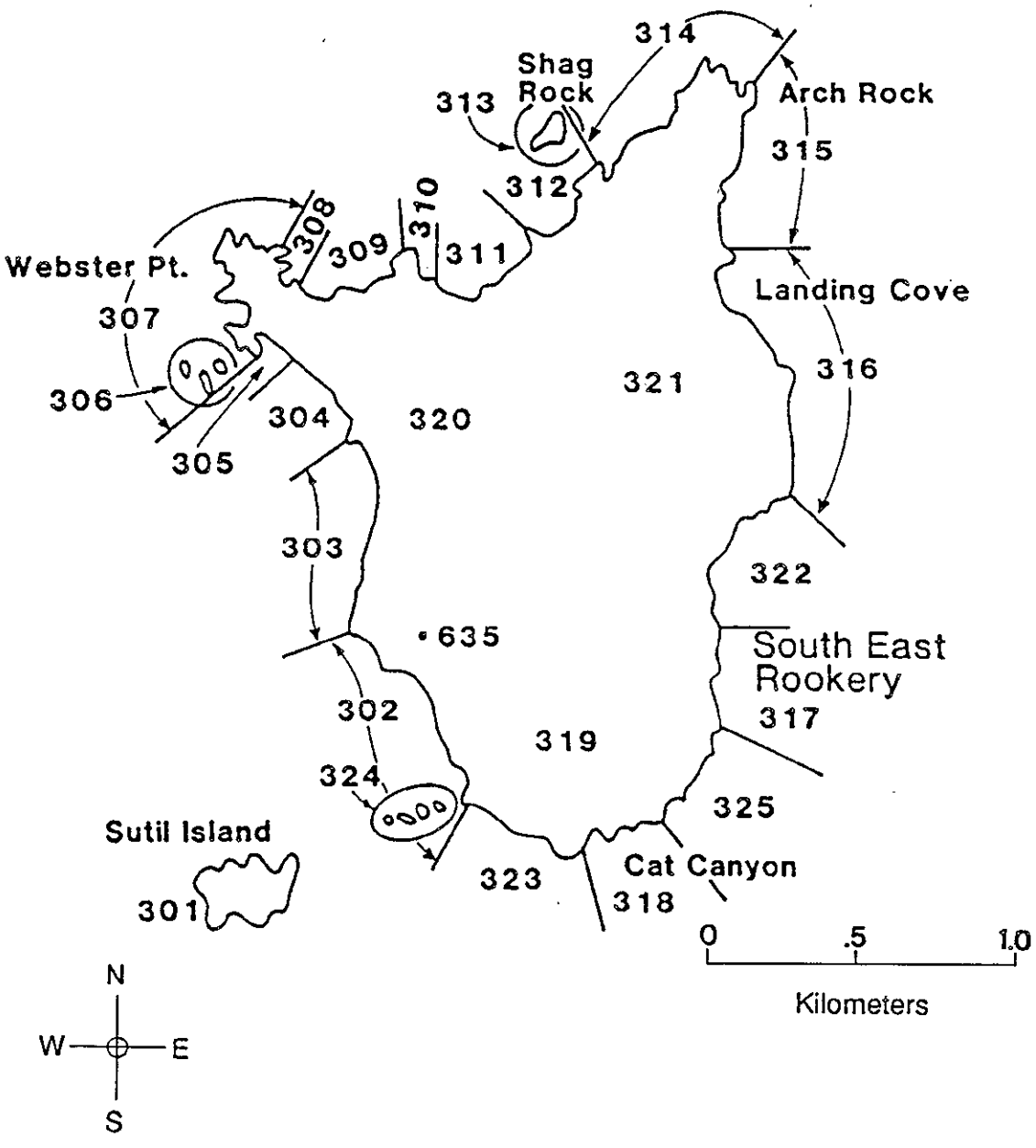






ANACAPA ISLAND

Figure A - 4. Pinniped BLM Location Codes



SANTA BARBARA ISLAND

Figure A - 5. Pinniped BLM Location Codes

APPENDIX B. Pinniped Census Data Form and Data Requirements (see data requirements on next page)

Observers:

Weather: Wind speed and direction
Cloud cover
Temperature
Tide height

Disturbance:

Survey Platform:

Field Party Leader:

SPECIES

Island	Beach (BLM Code)	Date	Time Start	Time End	*Zalophus* pups	*Zalophus* total	*Callorhinus* pups	*Callorhinus* total	*Mirounga* pups	*Mirounga* total	*Phoca* pups	*Phoca* total	Other Comments

Data Requirements for Pinniped Census Data Form

FIELD	DATA	CODES	FIELD LENGTH	COLUMNS
1	Date	yr/mo/day	6	1-6
2	Time: start	military	4	7-10
3	Time: end	military	4	11-14
4	Island	SMI ANI SRI SBI SCI	3	15-17
5	Beach	BLM code	3	18-20
6	Survey platform	GO - ground count A3 - aerial count, 35-mm format AV - aerial count, visual A5 - aerial count, 5-in format VV - vessel, visual count	2	21-22
7	Field party leader	initials	3	23-25
8	Counts			
	Zalophus	total counts	4	26-29
		pup counts	3	30-32
	Callorhinus	total counts	4	33-36
		pup counts	3	37-39
	Mirounga	total counts	4	40-43
		pup counts	3	44-46
	Phoca	total counts	4	47-50
		pup counts	3	51-53
	Arctocephalus	total counts	2	54-55
	Eumetopias	total counts	2	56-57
9	Wind speed	mph	2	58-59
10	Wind direction	8 pts	2	60-61
11	Cloud cover	c - clear (0% clouds) s - scattered (1-50% clouds) b - broken (50-98% clouds) o - overcast (100% clouds)	1	62
12	Temperature	centigrade	2	63-64
13	Tide height	F 3.1 meters	3	65-67
14	Disturbance	P - people on beach V - vessel near beach D - dog on beach	2	68-69